State of California
The Resources Agency
Department of Fish and Game

RECOVERY STRATEGY FOR CALIFORNIA COHO SALMON

Report to the California Fish and Game Commission

Prepared by
The California Department of Fish and Game

Species Recovery Plan Report 2003-1

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Appendices

Abbreviations and Acronyms

ABAG	Association of Bay Area Governments
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOF	California Board of Forestry and Fire Protection
CCC Coho ESU	Central California Coast Coho Evolutionarily Significant Unit
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFIP	California Forest Improvement Program
CGS	California Geological Survey (formerly Division of Mines and Geology)
Commission	California Fish and Game Commission
CRMP	Coordinated Resources Management Planning
CRT	California Statewide Recovery Team
CWA	Clean Water Act
Department	California Department of Fish and Game
DIRT	Direct Inventory of Roads and their Treatment
DO	Dissolved Oxygen
DOI	Department of the Interior
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
ENSO	El Niño/Southern Oscillation

EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FGC	California Fish and Game Code
FPA	Forest Practice Act
FPR	Forest Practice Rules
FRGP	Fisheries Restoration Grant Program
FWS	United States Fish and Wildlife Service
GIS	Geographic Information System
HA	Hydrologic Area
HCP	Habitat Conservation Plan
HGMP	Hatchery Genetic Management Plan
HQI	Habitat Quality Index
HSA	Hydrologic Subarea
HU	Hydrologic Unit
LWD	Large Woody Debris
MMWD	Marin Municipal Water District
MOA	Memorandum of Agreement
NCWAP	North Coast Watershed Assessment Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Adminstration
NTP	Non-industrial Timber Plan
NTU	Nephelometric Turbidity Unit
PALCO	Pacific Lumber Company
PCSRF	Pacific Coastal Salmon Recovery Fund
PDO	Pacific (inter)Decadal Oscillation
PFMC	Pacific Fishery Management Council

PIT	Passive Integrated Transponder
RCD	Resource Conservation District
RM	River Mile
ROD	Record of Decision
RPF	Registered Professional Foresters
RWQCB	California Regional Water Quality Control Board
SMARA	Surface Mine and Reclamation Act
SONCC Coho ESU	Southern Oregon/Northern California Coasts Evolutionarily Significant Unit
SPAWN	Salmon Protection and Watershed Network
SRAC	Smith River Advisory Council
SRWC	Scott River Watershed Council
SSRT	Shasta-Scott Recovery Team
SWRCB	State Water Resources Control Board
SYP	Sustained Yield Plans
T & I	Threatened and Impaired Water Body
THP	Timber Harvest Plan
TMDL	Total Maximum Daily Load
TRT	Technical Review Team
UPGMA	Unweighted Pair Group Method with Arithmetic Averages
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

Glossary B

Adaptive management: A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form, active adaptive management employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed.

Adverse effects of water diversions: Removal of water from a system that reduces flows to the point where coho salmon summer rearing habitat is reduced or eliminated; groundwater is reduced so that riparian vegetation is significantly reduced; natural function of the stream and its structural complexity are reduced; or where other negative impacts on coho salmon significantly reduce their productivity.

Alevin: Stage in the life cycle of salmon following emergence from the egg stage, characterized by the presence of a yolk sac attached to the body.

Allele: Any of the different forms of a gene.

Allele frequency: The proportion of a particular allele in a population.

Allozyme: Variant form of an enzyme encoded by a particular allele at a given locus. Allozymes can often be distinguished by protein electrophoresis.

Alluvial: Composed of material deposited by running water.

Artificial propagation: Human assistance in the reproduction of an organism. In Pacific salmon, artificial propagation may include spawning and rearing in hatcheries, stock transfers, creation of spawning habitat, egg bank programs, captive broodstock programs, and cryopreservation of gametes.

Barriers to passage: Any physical, chemical, or biological factor that interferes with the natural passage of salmon through their freshwater habitat, including dams, inappropriate water flow or temperature, pollution, and predators.

Benthic: Belonging or pertaining to the bottom sediment zone of a body of water.

Biological refugia: For Pacific salmon, parts of the freshwater habitat unperturbed by human activities or other factors that would diminish the natural production of a population.

Brood-year: (Synonym: Cohort). A group of fish that hatched during a given spawning season. When the spawning season spans portions of more than one year, as it does for coho salmon, the brood-year is identified by the year in which spawning began. For example, offspring of coho salmon that spawned in 1996-1997 are identified as “brood-year 1996." Because virtually all female coho salmon of a brood year return to spawn after one summer of freshwater life and two summers of ocean life, a brood year tends to form a consistent lineage.

By-catch: Non-target fish or other organisms caught in a particular fishery. Among Pacific salmon, coho salmon may constitute part of the by-catch of the commercial Chinook salmon fishery.

By-catch restrictions: Legal or regulatory provisions that limit the type and amount of by-catch permitted in a fishery.

Captive broodstock program: A form of artificial propagation involving the collection of individuals from a natural population and using them in captivity to produce subsequent generations.

Carrying capacity: The maximum equilibrium number of fish (or other organisms) of a particular species that can be supported indefinitely in a given environment. Abbr.: K.

Ceremonial fishery: The harvest of fish or other aquatic resource in observance of native American traditions.

Cohort: (Synonym: Brood-year). A group of fish that hatched during a given spawning season. When the spawning season spans portions of more than one year, as it does for coho salmon, the brood-year is identified by the year in which spawning began. For example, offspring of coho salmon that spawned in 1996-1997 are identified as “brood-year 1996."

Cohort failure: Extinction of a cohort (year-class) of fish due to either a lack of spawning in that year or the failure of any offspring of a spawning event to survive. Also called brood-year extinction.

Conservation hatchery: Fish hatchery that follows practices designed to stabilize and increase the size of a natural population while maintaining its phenotypic characteristics and genotypic integrity.

Consistent presence: Mapping convention based on existing coho salmon presence-absence surveys used to develop priotization maps for this recovery strategy. See discussion in Appendix F.

Conspecific: Belonging to the same species.

Critical flows for coho salmon: The minimum amount of water in a stream necessary to provide adequate juvenile rearing habitat, spawning habitat, and flows needed for migration. These flows vary by season and by stream.

Cryopreservation: Preservation of living gametes at very low temperature. Typically, freezing and storage of sperm in liquid nitrogen for later use in spawning.

Dendrogram: A branching diagram showing hierarchical structure in a data set resulting from cluster analysis (a type of statisitical analysis for grouping individuals or units based on quantifiable similarities). Dedrograms are often used to show the genetic relationships among populations or higher taxa.

Department: The State of California Resources Agency, Department of Fish and Game.

Desiccation: Drying

Domestication selection: Selection operating on a population during artificial propagation that produces adaptation to the hatchery environment. Domestication selection results in elimination of individuals, some of which may be well adapted to the natural environment.

Economically sustainable management of forest and agricultural lands: Forestry and farming practices that are profitable and don't adversely affect the environment.

Effective population size: The effective number of breeding individuals in a population. The size of a hypothetical idealized population that would exhibit the same amount of genetic drift and loss of genetic variation as the actual population. Typically the effective population size is lower than the actual or census population size. Abbr.: N_e.

El Niño / Southern Oscillation (ENSO): A term describing fluctuations of the ocean-atmosphere system in the tropical Pacific that can have secondary effects in the north Pacific range of coho salmon. During El Niño conditions the normal westerly trade winds across the tropical Pacific relax, creating (among many other effects) a rise in sea-surface temperatures in the eastern Pacific along South America. During strong El Niño events, sea surface temperatures along California may also

increase and can contribute to poor ocean survival of coho salmon. The reversal of this condition (the Southern Oscillation or La Niña) produces a decrease in sea surface temperatures and is often associated with good ocean survival of coho salmon. Typical ENSO events are of relatively short duration, lasting between 6-18 months. See also Pacific (Inter)Decadal Oscillation.

Embeddedness: The degree to which rocks and gravel are surrounded or covered by fine sediment on a stream or lake bottom.

Emigration: Seaward migration of salmon from their natal streams to the ocean. Also called 'outmigration'.

Environmentally sound growth and water supply development: Land use and infrastructure development for urban, rural residential, commercial, and agriculutral purposes that is planned and carried out so that it does not adversely affect coho salmon habitat. Specific issues with potentially adverse effects on coho salmon habitat include removal of riparian vegetation, reduction of stream flows, increases in water temperature, introduction of barriers to passage, excessive sediment supply, depletion of spawning gravels, increases in pollutants, or harm to the geomorphologic charatersitics of coho streams.

Epibenthic: Belonging or pertaining to the top surface of the bottom sediment zone of a body of water.

Estuary: The seaward end or the widened tidal mouth of a river where fresh water comes into contact with seawater and where tidal effects are evident.

Evolutionarily Significant Unit (ESU): A population or group of populations that is considered distinct, and hence a species, for purposes of the Endangered Species Act. An ESU must be reproductively isolated from other populations of the same species and must represent an important component in the evolutionary legacy of the species.

Extinction: In evolutionary biology, the failure of a group of organisms of variable size and inclusiveness (e.g., ranging from local geographic or temporally defined groups to species) to have surviving descendents.

Extinction risk: In this document, the probability that a given population will become extinct within 100 years. The number of individuals that would ensure population viability with a negligible probability of extinction over 100 years is difficult to calculate. Concurrent with the federal coho recovery process, population viability analysis will be used to determine the coho salmon population sizes required to reduce the risk of extinction to a negligble (insignificant) level.

Fecundity: In salmon, the number of eggs produced by a female.

Fishery: A resource exploitation system that includes a specific aquatic resource such as fish, a fishing community, and all biological, economic, and social factors affecting it.

FishNet 4C Program: The FishNet 4C program is a county-based salmonid protection and restoration program that brings together the six Central California Coastal counties of Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, and Monterey to address county land management regulations and practices that may affect salmonid populations.

Fitness: The probability of an organism to reach reproductive age and produce viable offspring. For a population, fitness is the frequency distribution of reproductive success of sexually mature adults.

Five Counties Salmonid Conservation Program: The Five Counties Salmonid Conservation Program is a county-based salmonid protection and habitat restoration program which includes Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties.

Flood plain: Terrace of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regime and covered with water when the river overflows its banks. A river has one flood plain and may have one or more terraces representing abandoned flood plains.

Fragmentation: In reference to salmon, the loss of connection of freshwater habitat due to migration barriers such as impassable dams or inadequate water quantity or quality, resulting in the inability of the fish to reach and fully utilize the habitat necessary to complete their life cycle and maintain natural levels of productivity.

Fresh water: Water containing only small quantities of dissolved salts and minerals.

Freshet (or Storm Flow): Rapid temporary rise in stream discharge caused by heavy rain or rapid melting of snow or ice.

Fry: Stage in the life cycle of salmon following the ‘alevin’ stage, characterized by the loss of the yolk sac and beginning of feeding on external prey.

Gene flow: The introduction of genes into the gene pool of a population due to migration of individuals between populations.

Genetic drift: Random changes in allele frequencies due to the sampling error associated with a moderate to small number of matings. Genetic drift typically results in the loss of genetic variation (e.g., loss of rare alleles or decrease of heterozygosity) and increases as the effective population size (N_e) decreases.

Habitat essential (for coho salmon): Coho salmon habitat needed to recover coho salmon populations to a high enough level to reduce the risk of extinction to a neglible level. Essential habitat will be determined as part of the process outlined in Section 4.2 IV.

Hatchery-origin fish: Also called "hatchery fish". Fish that have spent some portion of their lives, usually their early lives, in a hatchery. (See natural-origin fish.)

Heterozygosity: The fraction of individuals in a population that are heterozygous (having two different alleles) at a particular locus. Also, the fraction of heterozygous loci in the genome of an individual.

Hydrologic connectivity: A direct connection between run-off to a stream and development sites, typically roads, that contributes sediment or other pollutants to the stream.

Immigration: Migration of salmon from the ocean to their freshwater spawning grounds.

Incidental mortality: The unintentional death of an organism caused during the course of an otherwise lawful activity. In the context of Section 4.2.1, Recreational Fishing, this refers to coho salmon who die after being caught and released by anglers fishing for other species.

Incidental take: Unintended killing or harming of individuals of a threatened or endangered species associated with an otherwise lawful activity.

Interim actions: Actions contributing to recovery that will be immediate in their implementation. These actions may be of temporary duration to meet an urgent need or they may lay the groundwork for more longterm actions**.**

Interstices: The physical spaces between gravel or other substrate particles.

Intragravel: Within the gravel substrate of a stream.

Invasive non-native species: Animal or plant species present in an ecosystem where it did not naturally evolve and spreading invasively with significant negative effects on native animal or plant species.

Lagoon: Within the range of coho salmon, a lagoon is an estuary that is separated from tidal action during the summer by the formation of a sand bar at its mouth. This is the case in many California coastal streams and rivers.

Large woody debris (LWD): Large, relatively stable woody material usually having a diameter greater than 30 cm (12 inches) and a length greater than 2 m (6 feet) that intrudes into the stream channel.

Legacy effects: Unnatural landscape or ecosystem perturbations resulting from environmentally unsustainable historic human resource use.

Locus (*Pl.*: Loci): The physical location of a gene or other DNA sequence on a chromosome.

Macroinvertebrates: Aquatic invertebrates that conventionally are at least 0.5 mm in length and live primarily on the bottom substrate of streams and rivers. They feed on plant matter, detritus, or smaller animals and, in turn, provide food for larger consumers such as fish.

Maintain: To prevent further decline in the number and size of populations and the amount and quality of their habitat.

Metapopulation: A set of variously isolated subpopulations connected by some degree of migration among them.

Microsatellite DNA: DNA sequences consisting of tandem repeats of short oligonucleotide sequences, such as poly-(AT) or poly-(TAGC). The repeats are usually two to five nucleotides long and are inherited in a Mendelian fashion. Analysis of microsatellite inheritance can be used to gain information about microevolutionary processes such as migration and gene flow.

Milt: Sperm.

Monitoring: Scientific inquiry focused on evaluation of a program in relation to its goals (see Research).

Morphology: The physical shape of an organism and its parts.

Natural-origin fish: Also called “natural fish”. Fish that are offspring of parents that spawned in the wild. Natural-origin fish spend their entire lives in the natural environment. (See hatchery-origin fish.)

Negligible probability of extinction: See ‘Extinction risk’.

Non-native fish species: Fish species inhabiting an ecosystem where it did not naturally evolve.

Off-stream storage: Storage of ground or suface water in ponds, tanks or other surface or underground impoundments that are not directly connected to active stream channels.

Pacific (Inter)Decadal Oscillation (PDO): The "Pacific Decadal Oscillation" (PDO) describes a long-lived pattern of Pacific climate variability that can affect ocean survival of coho salmon. Unlike El Niño/Southern Oscillation events, which originate in the tropics and last from 6-18 months, PDO events origniate in the northeastern Pacific and cycle over periods of about 50 years. Within a PDO cycle there may be short lived reversals of conditions. “Warm” or “positive” PDO phases are associated with enhanced ocean productivity in Alaska and inhibited productivity off the west coast of the contiguous United States. “Cold” or “negative” PDO eras have the opposite pattern, and are generally favorable for ocean survival of coho salmon from California. Causes for the PDO are not currently known.

Parr: Stage in the life cycle of salmon following the ‘fry’ stage, characterized by the presence of dark vertical bands on the side of its body.

Population: (Synonym: Stock). A group of randomly interbreeding individuals of the same species that live in the same place at the same time and exhibit some level of reproductive isolation from other such groups. A salmon population may consist of a single isolated run or more than one run with some degree of gene flow. Synonymous with “stock” in this document.

Population assessment: Determination of the presence, size, and distribution of populations of a species, including historic and current presence and abundance.

Population risk: Defined here as risks to coho salmon from human activities (state-wide coho salmon population abundance and genetic data are not available). It combines anthropogenic risk factors (e.g., human population density, water diversions, road density) and population parameters (e.g., consistent presence of coho salmon, isolation index for coho salmon populations, and run length of coho salmon populations).

Population size: (Synonym: Abundance). In this document, the number of fish (usually adult) in the population. Also called census size of the population.

Population viability analysis: Analysis of a species and its population genetic structure to determine the level of independence of the populations. A viable salmonid population has been defined by NOAA Fisheries as “ an independent

population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame."

Professional fisheries scientist: A fisheries biologist who is certified by the American Fisheries Society or who has equivalent qualifications.

Properly Functioning Condition (PFC), with regard to conifer LWD recruitment: A concept used by NOAA Fisheries to describe the sustained presence of natural processes leading to habitat conditions that are necessary for the long-term survival and recovery of a fish species through the full range of environmental variation. In terms of conifer LWD recruitment, PFC refers to achieving a natural rate of large conifers falling directly in or sliding downslope to become active in channel processes such as pool formation, sediment retention, or otherwise providing the habitat complexity sufficient to ensure long-term survival of salmonid populations. This rate of LWD recruitment is to be determined by the best available science. (NMFS 1999).

Protect: To ensure the status and integrity of coho salmon populations, habitat, and essential ecological processes.

Rearing habitat: Habitat supporting coho salmon during their first year of life in fresh water, before downstream migration.

Recovery: The re-establishment or rehabilitation of a threatened or endangered species to a self-sustaining level in its natural ecosystem at which its risk of extinction becomes negligible. The point defined by attainment of established recovery goals.

Recovery supplementation: Short-term artificial propagation designed to reduce the risk of extinction of a small or chaotically fluctuating recovering population in its natural habitat by temporarily increasing population size using conservation hatchery fish, while maintaining genetic diversity and minimizing genetic change in the natural and hatchery populations.

Redd: Nest of a salmon, usually a depression within the gravel substrate of a stream, into which the female deposits her eggs.

Refugia: An area that consistently supports a coho salmon population (including both continued presence and adequate abundance) that can serve as a source to repopulate nearby streams. At the present time, primarily only presence/absence data are available to identify refugia.

Refugia watersheds: Defined here using presence of coho salmon, since abundance or population information is not available for all watersheds in the state. In the SONCC ESU, those watersheds having consistent presence of coho salmon greater than 50% are considered refugia. In the CCC ESU, those watersheds having consistent presence of coho salmon greater than 10% are considered refugia.

Registered geologist: Geologist holding a valid registration in California which means having a minimum of a bachelor's degree in geology and five years' experience at a professional level as well as passing the exam of the state licensing Board for Geologists and Geophysicists.

Reproductive isolation: Absence of gene flow between a population and other populations of the same species.

Research: Scientific inquiry focused on answering original questions. May consist of experiments or original descriptions of structures, relationships, and processes. (See Monitoring).

Restore: In the context of coho salmon recovery, to return coho salmon to self-sustaining levels within their natural habitat throughout their historic range, or to return habitat attributes (e.g., flow, sediment characteristics, water temperature, water quality and habitat complexity) to a condition that will support the recovery of coho salmon to self-sustaining levels.

Riffle: A shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation. Substrate is usually composed of gravel, pebble, and cobble-sized particles.

Riparian zone: The terrestrial zone adjacent to a stream or river.

Riparian restoration: The re-establishment of a naturally functioning riparian zone, using techniques such as bank stabilization to reduce erosion, elimination of invasive non-native plant species, and planting of native plant species as necessary.

Riparian vegetation communities: The various plant species that are found growing in mixed patterns in the riparian zone.

Road assessment: The inspection of stream crossings (including culverts and bridges), road sufaces, associated cut and fill slopes, and drainage structures (cross drains and ditches) to determine existing or potential sources of sediment delivery due to improper design, structural failure, or lack of maintenance. Any barriers to fish passage caused by stream crossing structures is also determined. The assessment includes recommended measures for correcting any problems and may also include a

prioritization of work points or road stretches based on estimated volume of sediment delivery, proximity to fish-bearing streams, and potential for failure.

Run: The spawning adults of a given species that return to a stream during a given season.

Salmonid: Any fish species belonging to the Family Salmonidae, including salmon and trout.

Self-sustaining population: A population that perpetuates itself in the absence of human intervention, without chronic decline, and in its natural ecosystem, at levels sufficient to make listing under CESA unwarranted.

Short-term actions: Actions contributing to recovery that can commence immediately or in the near future (i.e., within 5 years).

Siltation: The deposition and build-up of silt (detrital rock particle having a diameter in the range of 1/256 to 1/16 mm) that is suspended in a body of water. The term is often used to include larger and smaller sedimentary particles ranging in size from clay to sand.

Sink population or subpopulation: Populations that, within a given metapopulation structure of a species, are characterized by vastly lower productivities than other (source) populations and consistently receive individuals from the source populations through one-way movement of migrants.

Slackwater: Any stretch of water having little or no current, such as on the inside of a river bend or a backwater or side channel with slow-moving flow.

Smolt: Stage in the life cycle of salmon following the 'parr' stage, characterized by hormonal and other physiological changes that prepare the fish for its seaward migration and life in salt water, the loss of parr marks, and appearance of a silvery color.

Smoltification: Hormonal and other physiological changes associated with the seaward migration of salmon and adaptation to a saltwater environment.

Source population or subpopulation: Populations that, within a given metapopulation structure of a species, are characterized by vastly higher productivities than other (sink) populations and consistently contribute individuals to the sink populations through one-way movement of migrants.

Source-sink relationship: Metapopulation structure in which subpopulations in the source areas have vastly higher productivities than those in the sink areas, and characterized by one-way movement of migrants from the source area to the sink area.

Spawn: The process of depositing eggs by a female fish and fertilization by a male.

Spawner: Male or female fish ready for or engaged in spawning.

Stock: See population.

Stock transfer: Human transfer of fish from one location to another, often between separate basins or ESUs.

S**tream buffer zone:** Riparian zone of specified width that is given some measure of protection from developmental activities such as logging or road construction.

Subsistence fishery: A fishery that serves only as a food source or as the basis for small-scale trading commerce for its fishing community.

Substrate: Particulate material comprising the bottom of a body of water, such as mud, silt, gravel, or rock.

Suspended sediment: Material (usually clay, silt, and sand) carried for a considerable period of time in suspension without deposition on the bed of the body of water .

Sustained increase: Consistent presence of positive change.

Supersaturation: Presence of a solute (e.g., salt or oxygen) in a solvent at levels that exceed saturation for a given set of conditions, especially temperature and pressure.

Take: Under CESA **(**§ 86 of the Fish and Game Code), "take" is defined as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The federal ESA defines “take”more broadly as “harrass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such activity.”

TMDL (Total Maximum Daily Load) process: The TMDL process was established by the Clean Water Act, Section 303(d) to guide application of state standards to protect the designated "beneficial uses" (e.g. fishing, swimming, drinking, fish habitat, agriculture, aesthetic, etc.) of individual water bodies/watersheds. In California, the development of TMDLs for a water body determined to be impaired

for given pollutants is accompanied by the development of a water quality attainment strategy that describes how water quality standards will be attained.

Transferrin: A protein synthesized in the liver that transports iron in the blood to the erythrocytes for use in heme synthesis. Transferrin has been used in the past in immunological procedures such as microcomplement fixation assays to examine the genetic relationship between populations and other related taxa.

Turbidity: Reduced clarity of a liquid due to the presence of suspended matter.

Unnecessary and wasteful use of water: Article X §2 of the California Constitution requires "...that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare." What is considered wasteful or unreasonable is usually determined on a case-by-case basis by the SWRCB or the courts.

Watershed: The topographic region drained by or contributing water to a stream, river system, or lake.

Wetland habitat: Structural and chemical elements within wet areas that make them suitable for habitation by plants and animal species. The EPA and the U.S. Army Corps of Engineers define a wetland as made of "areas saturated by surface or ground water so that they support vegetation adapted for life in saturated soil conditions".

Yolk sac: An external pouch containing nutrients for the growing alevin. When the yolk sac is used up, the alevin is said to be "buttoned- up" and enters the fry stage.

C Other Species at Risk

Recovery actions and activities for coho salmon have the potential to affect other species listed under the Federal Endangered Species Act of 1973, as amended (ESA)[16 USC §§1531 *et seq*.] and under the California Endangered Species Act (CESA)[Fish and Game Code §§2050 *et seq.*]. Potential effects could range from beneficial to detrimental to the conservation of these species.

CONSTRAINTS ON RECOVERY ACTIONS

The presence of listed species may limit coho recovery actions that can be used at a site. For example, vortex rock weirs are commonly used to improve pool development for juvenile coho (Flosi et al. 1998), but these structures are not permitted in streams where California freshwater shrimp are present. The presence of other listed species may also increase the time and/or cost required to implement a coho recovery action. For example, to avoid noise disturbance to nesting marbled murrelets, heavy equipment work is typically prohibited within known murrelet habitat until after September 15. This restricts the work window to conduct some projects requiring heavy equipment, and can cause significant delays. In turn, delays can increases costs such as equipment mobilization and may create problems for projects involving public funds, which are typically allocated for a set time period.

Coho salmon recovery actions are not expected to have long-term adverse impacts on other listed species. However, recovery actions may require consulation with appropriate agencies, and/or the issuance of incidental take authorizations and/or other permits.

The presence of listed species (including coho salmon) could also increase the time and cost of California Environmental Quality Act (CEQA) review required for State or local permits associated with coho recovery. The CEQA mandatory findings of significance (CEQA Guidelines section 15065(a)) require an Environmental Impact Report (EIR) if an action has the potential to "...reduce the number or restrict the range of a rare or endangered plant or animal..." Under existing case law, the threshold for triggering this mandatory finding of significance is very low (San Bernardino Audubon Society v. Metropolitan Water District, 1999, 71Cal.App.4th 382). The additional time required for an EIR (as compared to a Negative Declaration (or a CEQA exemption) could significantly add to the time and cost required to implement a recovery action having the potential for "take." The Department and other implementing public agencies undertaking recovery actions will have to assess on a case-by-case basis the potential of the proposed action to meaningfully "reduce the number or restrict the range" of other listed species when approving recovery projects.

Another potential complication could occur if state-designated "fully protected" species are present, as the Department is prohibited from authorizing any take of

fully protected species, (See Fish and Game Code sections 5515, 5050, 3511 and 4700). The Commission can, however, authorize take of fully protected species for "necessary scientific research" and many recovery projects may be susceptible to design so as to avoid the take of fully protected species.

OTHER AT-RISK SPECIES IN THE RANGE OF COHO SALMON

Below are brief descriptions of other at-risk species that should be considered when implementing the coho salmon recovery strategy. Individual listed plant species are not discussed in this recovery strategy, although they also must be considered when implementing coho recovery actions. It has been the Department's practice for salmonid restoration grant projects to require rare plant surveys prior to implementing ground-disturbing actions and, if necessary, to modify projects to avoid any disturbance of rare plant colonies; in practice, conflicts between rare plants and salmonid habitat restoration actions have been infrequent and avoidance of such conflicts is relatively simple.

Trinity Bristle Snail (*Monadenia setosa*)

The Trinity bristle snail is listed as threatened under CESA and only occurs in the Trinity River HU This species typically occupies conifer and mixed conifer/hardwood stands with tree diameter greater than 11 inches at breast height and canopy cover greater than 60%. The snail prefers moist microhabitats where large woody debris is greater than 10 inches and is moderately decayed. Lichens and mosses on rocks and logs are typically present on occupied sites. Maple and alder tree species are often present, indicating a reliable moisture content on which the snails depend.

Increased large woody debris recruitment in riparian zones would benefit Trinity bristle snails. Areas of potential habitat within the range of the Trinity bristle snail should be surveyed according to published protocol prior to commencement of any coho salmon recovery activities. Occupied habitat will need to be identified and avoided. If a project would result in incidental take of Trinity bristle snail, the project would require incidental take authorization from the Department.

California Freshwater Shrimp *(Syncaris pacifica)*

The California freshwater shrimp is listed as endangered under both ESA and CESA. It is endemic to Marin, Sonoma, and Napa counties, where it occurs in low-gradient streams (<1%) with moderate to heavy riparian vegetation. Freshwater shrimp are ususally associated with pools 1-3 feet deep, especially those with stable undercut banks with exposed root systems and the top of the undercut below the water surface.

Protection and improvement of riparian habitat would increase vegetative cover required for protection from predators. Sediment control and placement of large

woody debris would improve habitat quality for shrimp by increasing pool development and structural cover. Replacement of culverts with bridges or arch culverts would promote connectivity of shrimp habitat. Fish habitat structures that completely span a stream (including vortex rock weirs) must be avoided in shrimp habitat to avoid creating barriers to instream movement of shrimp. Any planning for in-water work in shrimp habitat should include surveys to determine if they are present. If they are present, the project will require take authorization from U.S. Fish and Wildlife Service (FWS) and the Department.

Lost River Sucker (*Delistes luxatus*)

The Lost River sucker is listed as endangered under both ESA and CESA, and is fully protected. It is found in the Lost River system and the Upper Klamath River watershed. Undetermined populations are present in Copco and Iron Gate reservoirs; these populations are thought to maintained by fish entrained by the Klamath hydropower project

Maintaining lake levels to benefit suckers may, under certain conditions, impact the flows needed for coho salmon downstream. Screening water diversions to avoid entrainment of downstream migrant juvenile coho salmon would also avoid sucker entrainment.

Shortnose Sucker (*Chasmistes breviorostris*)

The shortnose sucker is listed as endangered under both ESA and CESA and it is a state fully protected species. Shortnose suckers are known to occur in the Upper Klamath River watershed with undetermined populations in Copco and Iron Gate reservoirs and most abundant populations in the Lost River system.

Maintaining lake levels to benefit suckers may, under certain conditions, impact the flows needed for coho salmon downstream. Screening water diversions to avoid entrainment of downstream migrant juvenile coho salmon would also avoid sucker entrainment.

Tidewater Goby (*Eucyclogobius newberryi*)

The tidewater goby is listed as endangered under ESA. The tidewater goby's habitat consists of brackish shallow lagoons and lower freshwater stream reaches where the water is fairly still but not stagnant. They tend to be associated with muddy substrates (Jim Watkins, personal communication 1/23/03).

In general, actions to restore coho salmon are not likely to impact tidewater goby, although efforts to protect and restore coho nursery habitat in estuaries is likely to have a positive influence on the preservation of goby habitat; this includes such actions as reestablishment of functional estuaries and lagoons by the removal, or

setback, of levees that confine the water course, and allowing for the reconnection of wetlands, sloughs, and the tidal influenced areas. Any planning for in-water work in goby habitat (such as placing LWD in estuaries) should include surveys to determine if goby presence. If gobies are present, the project will require take authorization from FWS.

Green Sturgeon (*Acipenser medirostris*)

In January 2003, NOAA fisheries determined that listing green sturgeon under the ESA was not warranted. However, because of uncertain population structure and status of the species, NOAA Fisheries is adding two distinct populations segments of green sturgeon (one north of the Eel River, the other south of the Eel River) to the agency's list of candidate species. Green sturgeon are presumed extant in the mainstem Klamath and Trinity river watersheds and possibly in the Eel River watershed.

Development of cold-water flows would decrease the incidence of disease outbreak and would benefit sturgeon in these systems. Implementing the Hardy Phase II flow regime in the Klamath River would give these fish greater access to the upper portion of the watershed for spawning. Control of upslope sedimentation through increased buffer areas and the reduction of human caused disturbances in unstable soil types. Also decreasing sediment input from existing roads by using the most recent sediment control solutions, by the decommissioning of unused roads targeting those within the riparian first, and when new roads are required building them near or on the ridge line to decrease sediment input into streams.

Steelhead *(Oncorhynchus mykiss)*

Northern California and Central California Coastal ESUs steelhead often share the same habitat or reaches of streams with coho salmon, therefore both species would likely benefit from habitat improvements projects for either species. Projects that decrease the sediment input into the stream, provide cooler (more optimal) water temperatures, and sufficient flows for all their life stages would benefit both of these species.

Chinook Salmon (*O. tshatwytscha*) - California Coastal ESU

Chinook salmon generally spawn in larger streams than coho salmon. Many of these streams are either migration corridors or are in themselves used by coho for spawning. Projects that decrease sediment input into streams, provide cooler (more optimal) water temperatures, and sufficient flows for all life stages would benefit both of these species.

Siskiyou Mountains Salamander (*Plethodon stormi*)

The Siskiyou Mountains salamander is a lungless, completely terrestrial salamander listed as threatened under CESA. This species occurs in the Applegate HU and Seiad Valley HSA, in Siskiyou County. Suitable habitat includes rock outcrops, talus (rock on rock substrates), and forested rocky soils. Areas of potential habitat within the range of the Siskiyou Mountains salamander should be surveyed according to published protocol prior to commencement of any coho salmon recovery activities. Occupied habitat will need to be identified and avoided. If the project would result in incidental take of Siskiyou Mountain salamander, the project would require incidental take authorization from the Department.

California Tiger Salamander (*Ambystoma californiense*)

Recommendations and actions associated with recovery of coho salmon in California are not expected to have adverse effects on California tiger salamander populations, because potential actions are not expected to overlap with their habitat.

California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog is listed as threatened under ESA. Within the range of the coho salmon, this listing does not include Humboldt, Trinity, and Mendocino counties, Sonoma County north of the Sonoma Creek and Petaluma River drainages, and Marin County north of the Walker Creek drainage. California red-legged frogs are associated with dense riparian vegetation closely associated with deep (>2 feet) still or slow moving water, and may estivate within 300 feet of a riparian area. The California red-legged frog is now found primarily in the wetlands and streams in the coastal drainages of central California and has a significant likelihood of co-occurring with coho salmon in the southern part of their range.

Although protection and improvement of habitat for coho salmon will sometimes improve habitat for California red-legged frogs, some activities to protect and restore coho habitat (for example projects requiring heavy equipment) have the potential to take frogs. Any planning for restoration actions in California red-legged frog habitat should include surveys for the species. If the project would result in take of California red-legged frogs, the project would require incidental take authorization from FWS.

San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*)

The San Francisco garter snake (SFGS) is listed as endangered under both ESA and CESA, and has State fully protected status. Presently, the range of the SFGS extends into northern Santa Cruz County, however known populations are relatively limited in extent. SFGS may co-occur with coho salmon in San Gregorio and La Honda creeks, Pescadero Marsh and Creek, Butano, Gazos, Old Woman, Whitehouse, and Waddell creeks.

Although protection and improvement of habitat for coho salmon will sometimes improve habitat for SFGS and their preferred prey (California red-legged frogs), some activities to protect and restore coho habitat have the potential to take SFGS. For example, grading of hillslopes to reduce stream sedimentation attributable to gullying is an important activity for coho recovery in coastal San Mateo County but can crush SFGS estivating in rodent burrows.

Because of the potential for take of SFGS, planning for coho habitat restoration activities within suitable habitat for the snake in San Mateo and Santa Cruz counties should include surveys for SFGS by a permitted biologist. If SFGS are identified at a project site, measures to avoid impacts would include (at least) that an experienced biologist, approved by the Department and named on a valid 10(a)(1)(A) Federal Scientific Collection Permit issued by USFWS for handling SFGS, be present during all project activities within areas of SFGS habitat. If necessary, habitat work could be scheduled to occur in September and October to avoid impacts to hibernating snakes and snakes concentrated along stream corridors feeding and giving birth to live young. Planning for coho recovery actions within the range of the SFGS will need to consider the time and budget required for permitting and coordination. Federal permitting for coho recovery actions in SFGS habitat could be facilitated by development of a programmatic FWS Section 7 consultation.

Greater Sandhill Crane (*Grus Canadensis tabida*)

The greater sandhill crane is listed as threatened under CESA and has state fully protected status. This species breeds in northeastern California, the western most extent being Scott Valley. This species relies on permanently flooded wetlands for nesting with nearby flood irrigated pasture to provide food for newly hatched colts. Impacts to nesting or brooding birds from project activities such as building riparian fencing adjacent to crane breeding habitat would have to be evaluated on a case-by-case basis. However, impacts can usually be mitigated and take avoided by avoiding disturbance during the critical nesting period (March 1 to August 1) or maintaining a distance of 0.5 mile from the potential breeding habitat. The Department is developing a recovery plan for this species.

California Brown Pelican (*Pelecanus occidentalis californicus*)

The California brown pelican is listed as endangered under both ESA and CESA and has State fully protected status. In Northern California, the Brown Pelican inhabits the coastline and estuaries mainly in the late summer and fall (June to November) and is considered uncommon to rare from December to May. Actions to restore coho salmon are not likely to impact this species, although efforts to protect and restore estuarine habitat may have a positive influence on this species. Most breeding occurs in Southern California (Channel Islands), outside of the range of coho salmon.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The western yellow-billed cuckoo is listed as endangered under CESA. The most recent information indicates nesting pairs have been found on the lower Eel River (below Fortuna). Historically, there are scattered records around Humboldt Bay and south along the coast, but breeding status was undetermined. Cuckoo breeding habitat consists of riparian areas with a cottonwood and/or willow component. Alders have been found to be component of the habitat utilized by the birds found on the Eel River. They breed later than most migrant species, beginning in June and continuing through September. Projects that would increase both the quantity and quality of riparian vegetation would benefit this species. Projects that would take place during the critical breeding period (June through September) would require surveys to determine presence. If the project would result in take of western yellow-billed cuckoo, incidental take authorization from the Department would be required.

Willow Flycatcher (*Empidonax traillii*)

Within the range of the coho, the willow flycatcher is listed as endangered under CESA. Protection and improvement of riparian habitat associated with coho recovery actions will promote potential willow flycatcher habitat. However, care must be taken to avoid disturbing breeding sites of the flycatcher. Impacts to breeding sites can be mitigated by avoiding heavy equipment work and harvest of willow branches for riparian revegetation within 0.25 miles of any site with known or potential habitat for willow flycatcher during the breeding season. By limiting the harvest of willow for revegetation to no more than one-third of any willow plant annually and taking care not trample or over harvest the willow sources, the long-term integrity of willow flycatcher habitat can be protected. If the project would result in take of willow flycatchers, incidental take authorization from the Department would be required.

Northern Spotted Owl (*Strix occidentalis caurina*)

The northern spotted owl is listed as threatened under ESA. Activities to protect and restore coho habitat should not alter habitat for the owls, however the potential exists for project-related noise (e.g., heavy equipment required for projects such as culvert removal or placement of large woody debris) to disturb nesting birds. Adverse impacts can be avoided by limiting heavy equipment work within 0.25 miles of spotted owl habitat to the period of August 1 to October 31. If the project would result in take of northern spotted owls, incidental take authorization from FWS and would be required.

Marbeled Murrelet (*Brachyramphus marmoratus marmoratus)*

The marbeled murrelet is listed as endangered under CESA and threatened under ESA. Activities to protect and restore coho habitat should not alter habitat for marbled murrelets, however the potential exists for project-related noise (e.g., heavy equipment required for projects such as culvert removal or placement of large woody

debris) to disturb nesting birds. Adverse impacts can be avoided by limiting heavy equipment work within 0.25 miles of marbeled murrelet habitat to the period of September 15 to October 31. If the project would result in take of marbled murrelets, incidental take authorization from FWS and the Department would be required.

Western Snowy Plover (*Charadrius alexandrinus nivosus*)

The western snowy plover is listed as threatened under ESA. Snowy plovers have mainly been described as nesting adjacent to tidal waters, however some individuals may breed on gravel bars in coastal rivers; in particular, nesting snowy plovers have been identified in the Eel River watershed up to 50 miles inland. Activities to protect and restore coho habitat should not alter habitat for snowy plover, however heavy equipment work in areas with extensive gravel bars relatively near the coast has the potential to disturb or injure nesting snowy plovers. Adverse impacts can be avoided by limiting heavy equipment work within 0.25 miles of snowy plover nesting habitat to the period October 1 to October 31. If the project would result in take of snowy plovers, incidental take authorization from FWS would be required.

Bank Swallow (*Riparia riparia*)

The bank swallow is listed as threatened under CESA. Presently the only known breeding population of bank swallows in the coho salmon range is along the Scott River. To avoid adverse impacts to bank swallows, any potential breeding habitat should be surveyed during the breeding season (March 1-July 31) to determine swallow presence. Any modification of bank swallow nesting habitat should be avoided. If the project would result in take of bank swallows, incidental take authorization from the Department would be required.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is listed as endangered under CESA and threatened under ESA. The bald eagle is also protected under Fish and Game Code section 3503.5, which prohibits take. Recovery of coho salmon will increase winter foraging opportunities for bald eagles. However, the potential exists for the noise from heavy equipment required for projects such as culvert removal or placement of large woody debris to disturb nesting birds. Such impacts can be avoided by limiting heavy equipment work within 0.25 miles of any bald eagle nests to the period of September 1 to October 31. To prevent possible impacts of turbidity on bald eagle foraging, necessary precautions must be used to avoid significant increases in turbidity during any construction, and erosion control measures must be in place before the first significant fall rains.

California Clapper Rail (*Rallus longirostris obsoletus*)

The California clapper rail is listed as endangered under ESA and CESA, and has State fully protected status. California clapper rails are found in tidal marshes around San Francisco Bay. In general, actions to restore coho salmon are not likely to impact this species, although efforts to protect and restore coho nursery habitat in estuaries may have a positive influence on the preservation of marsh habitat for this species.

California Black Rail (*Laterallus jamaicensis coturniculus*)

The California black rail is listed as threatened under CESA and has State fully protected status. The California black rail is more widely distributed than the California clapper rail, from San Francisco Bay south and in both brackish and freshwater marsh habitat. In general, actions to restore coho salmon are not likely to impact this species, although efforts to protect and restore coho nursery habitat in estuaries is likely to have a positive influence on the preservation of marsh habitat for this speices.

Point Arena Mountain Beaver (*Aplodontia rufa nigra*)

The Point Arena mountain beaver is listed as endangered under ESA. Point Arena mountain beavers have been identified in the Alder Creek, Brush Creek, and Garcia River HSAs, in an area extending roughly five miles south and eight miles north of Point Arena, and up to approximately five miles inland from the coast.

Aspects of mountain beaver habitat are consistent with coho habitat (such cool climate, lush vegetation, stable stream banks), however some common habitat restoration methods (such as tree planting) may not be compatible with the herbaceous and small woody vegetation associated with mountain beaver habitat. In addition, special care is needed when working (or walking) in mountain beaver habitat to avoid collapsing burrows. Disturbance during the breeding season (December 15 – April 15) or juvenile dispersal season (December 15 – June 15) should be avoided in the course of adhering to criteria for protection of salmonids (i.e., no instream work until after July 1). Because of the potential for impacts to Point Arena mountain beaver, planning for coho habitat restoration activities within the riparian zone in the Alder Creek, Brush Creek, and Garcia River HSAs should include mountain beaver surveys. If Point Arena mountain beaver are present the project will require take authorization from FWS.

Salt-marsh Harvest Mouse (*Reithrodontomys raviventris*)

The salt marsh harvest mouse is listed as endangered under ESA and CESA, and has state fully protected status; they are found in tidal marshes around San Francisco Bay. In general, actions to restore coho salmon are not likely to impact this species, although efforts to protect and restore coho nursery habitat in estuaries may have a positive influence on the preservation of marsh habitat.

D Existing Watershed Programs, Groups, and Resources

GROUP	NAME	REGION COVERED	DESCRIPTION
Agriculture Conservation Committee Plan	California Association of Resource Conservation Districts	Statewide	To provide information review programs and provide input which affect farmland loss. Strengthen assistance to farmers and ranchers to address invasive and endangered species regulations. Educate RCD directors, partners, and legislature on animal and land management.
AmeriCorps Watershed Stewards Project (WSP)	none listed	none listed	The AmeriCorps Watershed Stewards Project (WSP) has formed a collaborative with timber companies. Commercial and sport fishing industry representatives, teachers, community members, non-profit organizations, and public agencies to conserve, restore, and sustain natural anadromous habitats for future generations.
Bureau of Land Management-Arcata Field Office	Lynda Roush	Pacific Southwest Region	It is the mission of the Bureau of Land Management to sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations.
California Cattlemen's Association	Ben Higgins	none listed	CCA has sponsored workshops with the assistance of U. C. Cooperative Extension and Natural Resources Conservation Service on water quality since 1996. The recently developed Watershed Resource Guide encourages and assists the formation of watershed groups.
California Dairy Quality Assurance Program	Deanne Meyer	Statewide	Voluntary, industry driven, offers continuing education and farm certification in: Food Safety/Emergency Preparedness; Environmental Stewardship; Animal Welfare 3 Components of Certification; Producer education (ESSC I), Producer develops an Environmental Stewardship Farm Management Plan, Third party diary evaluation.

GROUP	NAME	REGION COVERED	DESCRIPTION
California Watershed Assessment Manual	Fraser Shilling	North Coast, Central Coast, Central Valley, including the west-side Sierra Nevada. Other areas will be addressed in the next phase.	To assist watershed groups, local agencies, private landowners, and watershed specialists in assessing watershed condition. The manual will be a toolbox of approaches and protocols appropriate for analyzing a variety natural resource issues in creek and river basins throughout the state.
Central Coast Vineyard Team	Membership	Central Coast	The Central Coast Vineyard Team will identify and promote the most environmentally safe, viticulturally and economically sustainable farming methods, while maintaining or improving quality and flavor of wine grapes. The team will b ea model for wine grape growers and will promote the public trust of stewardship for natural resources.
Digger Creek Restoration	Mendocino Coast Botanical Gardens	Mendocino County	They have replaced a poorly functioning culvert with a bridge and plan to do additional work with a culvert replacement under Ocean Drive on the same stream.

GROUP	NAME	REGION COVERED	DESCRIPTION
Eel River Action Plan (River Basin & Watershed Plans)	Yager/Van Duzen Environmental Stewards (YES) Five Counties Salmonid Conservation Program The Eel River Watershed Improvement Group (ERWIG) The Mainstream Eel River Group (MERG) CA Conservation Corp (CCC) The Americorp Watershed Stewards Project (WSP) The Round Valley Indian Tribe Six Rivers National Forest Land & Resources Management Plan, 1995 Humboldt Redwoods State Park General Plan, 2001 Bureau of Land Management	Eel River/Van Duzen Rivers	There are several examples of watershed groups on the Eel River. Landowners have come together to develop watershed plans in cooperation with local, state and federal agencies. The Humboldt and Mendocino Resource Conservation Districts are instrumental to the recovery of coho salmon. The Humboldt County RCD through the "Lower Eel Basin Watershed Organizational Support Project" directs assistance to landowners and landowner based watershed groups leading to resource conservation and fish habitat improvements. This has been a very successful program that matches 319(h) funds from the California Water Quality Control Board and other implementation funds to implement watershed improvement projects.
Eel River Watershed Improvement Group (ERWIG)	none listed	North Coast	The Eel River Watershed Improvement Group (ERWIG) was formed in 1997 to develop cooperative relationships and implement fishery improvement projects with landowners in the Eel River system. It is focused on the lower Eel, Van Duzen River, South Fork Eel and associated tributaries.
Fish Friendly Farming Program	Sotoyome Resource Conservation District	Southern Sonoma County	The program is a voluntary certification program for grape growers who implement land management practices that restore and sustain fish habitat on their property. There are 4 workshops that assist farmers in completing a farm conservation plan using the programs Beneficial Management Practices for soil conservation, slopes, chemical use, water conservation, roads, erosion repairs, and an assessment and restoration of creek & river riparian corridors.

GROUP	NAME	REGION COVERED	DESCRIPTION
Five Counties Salmonid Conservation Program	none listed	Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties	The program is the first multiple country, watershed based conservation strategy formed in California to address the biological, watershed, political, social and economic effects of declining salmonid populations.
Gold Ridge RCD	Joe Pozzi	Western Sonoma County	The mission of the Gold Ridge RCD is to assist landowners in addressing their environmental concerns by maintaining a presence in natural resources conservation work in all watersheds within the District, to help involve landowners in Natural Resource Conservation Service projects and to provide a conduit for landowners through which state and federal monies can be obtained to support and implement restorative programs and practices.
Handbood for Prioritizing Watershed Protection and Restoration to Aid Recovery of Native Salmon (1995)	Dr. Willa Nehlsen	Pacific Northwest	Protecting and restoring watersheds is a key component to recovering salmon and other native fishes. With that goal in mind, in May 1994 Oregon State Senate President Bill Bradbury asked the Pacific Rivers Council for help in assembly a group to create a process for effective and scientifically-sound watershed protection and restoration.
Humboldt Bay Watershed Advisory Committee	none listed	Humboldt County	HBWAC has worked since 1997 to plan and guide cooperative salmon conservation efforts between local stakeholders while also considering regional ecological and socio-economic needs. They have recently prepared a conservation plan for salmon and steelhead trout.
Humboldt Bay Watershed Enhancement Program	none listed	Pacific Southwest Region	The Humboldt Bay Watershed Enhancement Program is a cooperative effort coordinated by the Natural Resources Services Division of Redwood Community Action Agency that involves timber companies, watershed restoration groups, contractors, a land trust, educators, volunteer monitors, private landowners, and government agencies. This program focuses on improving water quality and anadromous fisheries habitat within the Humboldt Bay watershed. The program is funded by the Environmental Protection agency grant program through the Calif. State Water Resources Control Board.

GROUP	NAME	REGION COVERED	DESCRIPTION
Humboldt Resource Conservation District	none listed	none listed	The Humboldt Resource Conservation District directs assistance to landowners and landowner based watershed groups leading to resource conservation and fish habitat improvements. Projects include the Lower Eel Basin Watershed Organizational Support Project to provide direct assistance to landowner based groups in the Middle and Lower mainstem Eel River and delta of the Van Duzen River, and South Fork Eel River Watersheds. Projects implemented include management of dairy wasted, stream bank erosion and riparian restoration,
Large Woody Debris in N. Coast Streams Conference	Gary Nakamura	North Coast Streams	A conference on measurement, monitoring & management of large woody debris in N. Coast Streams and to improve understanding of the complexities involved in large woody debris (LWD) management that will assist in better restoration with the right approaches in the right places.
Lindsay Creek Working Group	none listed	Mad River HU	Works to protect and restore watershed processes in this sub watershed.
Management Practices to Protect Water Quality	Central Coast Vineyard Team	Central Coast	View CCVT's demonstration sites and see how they held up through the first year of the project. Discuss seed selection, planting methods, and costs for establishing cover and preventing erosion in order to comply with Clean Water Act regulations.
Mattole Restoration Council	none listed	Cape Mendocino	The Mattole Restoration Council has performed habitat assessment from 1988 through 1994 and published "Good Roads, Clear Creeks."
Mattole Salmon Group	Mattole Salmon Group	Cape Mendocino	This citizen-run group was formed in 1980, has conducted spawning surveys since that time and has documented down-migration through migrant trapping. They raised coho salmon via hatch boxes and placed in streams. This group is part of the DFG Cooperative Trapping and Rearing Program. Produced with DFG a five-year plan that provides guidance to the cooperative rearing and rescue projects.
Mendocino County Gualala River Voluntary Watershed Group	none listed	North Coast, Mendocino County	Gualala River-Landowners from Mendocino and Sonoma Counties are members of the Gualala Council, which is supported by the Sonoma Sotoyome RCD Staff.

GROUP	NAME	REGION COVERED	DESCRIPTION
Mendocino County Garcia River Voluntary Watershed Group	Larry Mailliard	North Coast, Mendocino County	Garcia River-no staff, landowners group acting on their own, participated with UCCE to do research project on in-stream temperature monitoring with partial funding from CFBF, study to be released after per review.
Mendocino County Lower Albion Voluntary Watershed Group	Mike Jani	North Coast, Mendocino County	Lower Albion - no description of project
Mendocino County Navarro River Voluntary Watershed Group	Peter Bradford	North Coast, Mendocino County	Navarro River-landowners group - no staff
Mendocino County RCD Watershed Information Sharing Project	none listed	North Coast, Mendocino County	The RDC continues to develop working landowner watershed groups to increase resource conservation activities and education. The mission of MCRCD is to provide local leadership in the conservation of soil, water, and related natural resources through programs and partnerships with individuals, businesses, organizations and government.
Mendocino County Resource Conservation Restoration Projects	Janet Olave	SEE BELOW	The Mendocino County RCD has been in existence since 1945 and through the years has worked diligently to develop trusting relationships and strong partnerships with landowners, watershed groups, organizations, and government to accomplish conservation goals
Mendocino County Resource Conservation Restoration Projects	Janet Olave	Garcia Basin	Bluewaterhole Creek road related sediment delivery reduction project and implement water quality monitoring activities in five other tributaries over two year.

GROUP	NAME	REGION COVERED	DESCRIPTION
Mendocino County Resource Conservation Restoration Projects	Janet Olave	Navarro Basin	Complete the initial Navarro Implementation Plan and begin the second phase, initiate the Robinson Creek Restoration project and Lower Indian Creek Restoration projects, implement the Arundo Eradication project, complete sediment reduction projects on Holmes Ranch Road, Hungry Hollow, and Bates Road, implement the Mendocino Natives Nursery to establish a self-sustaining local business that provides native plants for riparian improvement, complete the Mill Creek Monitoring project, and complete and promote the Streamlined Permitting project.
Mendocino County Resource Conservation Restoration Projects	Janet Olave	Coastal Rivers Basin	Continue to explore conservation activities and support the work of the Noyo Watershed Alliance as requested.
Mendocino County Resource Conservation Restoration Projects	Janet Olave	Eel River Basin	Cooperate with Humboldt County RCD to continue to assist local South Fork Eel landowners develop restoration plans. Promote project effectiveness study conducted in String Creek and Streeter Creek.
Mendocino County Resource Conservation Restoration Projects	Janet Olave	Russian River Basin	Complete Feliz Creek Riparian Restoration and Fish Habitat Improvement project, complete NcNab Ranch Road Assessment and secure funding for implementation, initiate Forsyth Creek Assessment project and seek implementation funding sources, continue the sponsorship of the Watershed Coordinator and participate in the Russian River Watershed Council. Work with Soyotome RCD continuing to promote Fish Friendly Farming Techniques. Continue to work with landowners and watershed groups to identify other projects in the watershed.
Mendocino County Upper Albion Voluntary Watershed Group	George Hollister	North Coast, Mendocino County	Upper Albion-landowners group-no staff-no description of project

GROUP	NAME	REGION COVERED	DESCRIPTION
Mendocino County Voluntary Watershed Groups	Margaret Perry	Mendocino County	Ten Mile River Forest Landowners Association-The purpose of the association is, through cooperative self-help, to maintain, coordinate and facilitate the efforts of individual non-industrial landowners with Non-industrial Timber Management Plans who are interested in protecting, managing and improving their land, resources and the associated environment for the control of potential sources of nonpoint pollution, protection of surface and groundwater quality, and enhancement of aquatic habitat for native aquatic species.
Mendocino County Willits Voluntary Watershed Groups	Erlyne Schmidbauer	North Coast, Humboldt County	Willits-landowners group-Fish & Game funds for Davis Creek assessment through ERWIG out of Humboldt County-very large area with sub groups-drainage to the Eel River.
Rangeland Water Quality Shortcourse	Dr. Mel George, UCCE Range Specialist	Statewide	Statewide Survey to Evaluate: >Management practice implementation. >Reasons for implementation-document behavioral changes made after attending course. > Financial contributions to water quality management. >Impacts beyond 1.2 million acres. >753 surveys mailed 9/02-10/02 >35% return rate >Results: Ranch plan completed = 57% Practices implemented: 70% >Ranch Plan not completed= 43% Practices implemented: 40%
Rangeland Water Quality Shortcourse		Statewide	See above
Rangeland Water Quality Shortcourse		Statewide	See above
Rangeland Water Quality Shortcourse		Statewide	See above
Redwood Creek Landowners Association	none listed	Redwood Creek HU	Inventoried their properties with follow up upgrading and decommissioning of roads throughout the watershed to reduce future sediment impacts.

GROUP	NAME	REGION COVERED	DESCRIPTION
Removing Barriers to Restoration	Report of the Task Force to the Secretary for Resources	Statewide	Private landowners, watershed groups and other local stakeholders have a critical role to play in achieving California's conservation goals. To that end, the Task Force to Remove Barriers to Restoration was convened to provide guidance to the Resources Agency and other state agencies to work more effectively with California's landowners to restore our natural resources. In order to generate creative solutions to these concerns, representatives from landowner groups, State agencies and the professional restoration community met four times to examine barriers to restoration, identify options for fixing them, and recommended specific actions to move the best ideas forward.
San Luis Obispo County Farm Bureau Agricultural Watershed Program and Watershed Working Groups	San Luis Obispo County Farm Bureau	San Luis Obispo County	The County Committee is responsible for helping individual watershed working groups (the landowners on the individual streams and watersheds) organize, develop their plans, find financial assistance, and correlate the date. The County Committee is the liaison to the regulatory agencies.
Sotoyome Resource Conservation District Watershed Information Sharing Project		Sonoma County	The purpose of the District is to focus on soil, water, and related natural resource problems within the District; to develop programs to help solve those problems; and to enlist coordinate assistance from private and public agencies that can contribute to accomplishing sound land use. Voluntary activity is a key component to the workings of an RCD. Being non-regulatory, RCD's are the only grassroots conservation delivery system that works cooperatively with multiple agencies and interest groups to identify problems and guide voluntary solutions to these problems.
Southern Sonoma County RCD	Paul Sheffer	Southern Sonoma County	The SSCRCD, in cooperation with local landowners, created and published the Petaluma Watershed Enhancement Plan. This plan created the formation of the Petaluma Watershed Council dedicated to addressing the problems and questions facing the Petaluma Watershed.
Southern Sonoma County RCD	Allison Herman	Southern Sonoma County	In 1997, the SSCRCD prepared and distributed the Sonoma Creek Watershed Enhancement Plan. Since then the District has been busy implementing the plans goals and objectives as funding has allowed. Projects included Sonoma Creek Habitat Inventory, streambank stabilization and riparian corridor enhancement projects along Carriger and Nathanson creeks, and installation and maintenance of wood duck nesting boxes as well as other successful projects.

GROUP	NAME	REGION COVERED	DESCRIPTION
Southern Sonoma County RCD	Chris Delaney	Southern Sonoma County	The Stemple Creek Watershed Enhancement Plan was completed in 1994. Beginning in 1996 and continuing into 1997, the RCD completed a number of fencing projects for riparian habitat enhancement and erosion control for property owners along Stemple Creek. Project partners included Partners for Wildlife, the Sonoma County Fish & Wildlife Advisory Board and the Coastal Conservancy. In 1996, the RCD developed a model Dairy Construction Plan with landowners McClelland and Moretti. Another RCD partner, STRAW, created the "shrimp club" to assist local efforts i restoring habitat to enhance viability of the CA freshwater shrimp. In total, six miles of Stemple Creek has been restored collectively by all these partners.
Stream Steward Restoration Guide A Small Woodland Owners Guide to Stream Habitat Restoration	American Tree Farm System		The Stream Steward Restoration Guide provides Tree Farmers with a "crash course" in the basics of stream restoration. Since 1997 The American Tree Farm System and Trout Unlimited have worked together on Shared Streams projects that bring together tree farmers and fisheries and forestry experts to help restore and protect targeted watershed and their wildlife populations.
Sustainable Viticulture Program	California Association of Winegrape Growers	Central Coast, Sierra foothills, Central Valley	Sustainable agriculture integrates three main goals—environmental health, economic profitability, and social and economic equity. Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Key themes in sustainable agriculture include:· economic profitability (marketing and business planning, pricing structures, ag policy) · stewardship of both natural resources (soil, air and water resources, ecosystem health)· human health and well-being (working and living conditions for laborers, the needs of rural communities, and consumer health and safety)· systems perspective (allows a larger and more thorough view of the consequences of farming practices on both human communities and the environment, and provides tools to explore the interconnections between individual farms, the local ecosystem, and larger communities and ecosystems)· interdisciplinary efforts in research and education (input and cooperation among researchers and educators from various disciplines, farmers, farmworkers, consumers, policymakers and others)

GROUP	NAME	REGION COVERED	DESCRIPTION
Ten Mile River Forest Landowners Association	Nan Deniston		The purpose of the association is, through cooperative self-help, to maintain, coordinate, and facilitate the efforts of individual non-industrial landowners with Non-Industrial Timber Management Plans who are interested in protecting, managing and improving their land, resources and the associated environment for the control of potential sources of nonpoint pollution, protection of surface and groundwater quality, and enhancement of aquatic habitat for native aquatic species.
The California Freshwater Shrimp Project Publication	Laurette Rogers	Marin, Sonoma, Napa Counties	In 1993 a group of 4th grade students initiated "The California Freshwater Shrimp Project." To help preserve this endangered species they worked with ranchers to restore a creek habitat, presented to over 1,500 teachers and businesspeople, launched a media campaign, obtained over $100,000 in grants and awards, and applied academic skills to "real world" situations. The principles of project-based learning is discussed so that it can be applied to a variety of other situations.
The Fortuna Project	none listed	Humboldt County	The Fortuna Creeks project is a comprehensive watershed monitoring and restoration project for high school students, who conduct water quality testing, aquatic macroinvertebrate sampling and habitat typing for the lower Eel and Van Duzen Rivers. They also do bi-yearly creek clean-ups, increase public awareness about creek care and plant trees to bring back natural creek habitat and participate in spawner surveys to help monitor the local salmon population.
The Klamath Resource Information System The Ultimate Watershed Information Tool	Kier Associates	Klamath Basin	KRIS was developed by the fisheries and watershed professionals at Keir Associates, consultants in watershed and fish habitat assessment, restoration planning and implementation. This team is eager to bring KRIS' extraordinary date management power to the support of agency, landowner, and community watershed and fisheries protection and restoration programs.
The Mainstream Eel River Group (MERG)	none listed	North Coast	The Mainstream Eel River Group (MERG) works to educate and assist community members on salmonid restoration issues through the development and implementation of restoration projects. MERG works on the central mainstem from Dobbyns to Kekawakee.

GROUP	NAME	REGION COVERED	DESCRIPTION
The STRAW Project (Students and Teachers Restoring a Watershed)	Laurette Rogers	Marin, Sonoma, Napa Counties	The STRAW Project evolved out of the student-initiated Shrimp Project, which connected students and teachers with ranchers in order to restore creek habitat. More than half of all STRAW restorations occur on ranchland with the ranchers serving as teachers, leaders and partners. Since 1993, classes of students have worked with teachers, ranchers biologists and community members to help save endangered species in the North Bay through watershed restoration.
Tomales Bay Watershed Council	none listed	Tomales Bay	Tomales Bay Watershed Council has prepared the Preliminary Tomales Bay Watershed Stewardship Plan.
Water Quality and You: A special educational series	Western Shasta Resource Conservation District	Shasta County	Special Educational Series on Water Quality & You, created for the Cow Creek Watershed residents, landowners, and stakeholders funded by the David and Lucille Packard Foundation for the Western Shasta Resource Conservation District.
Water Resource Committee	California Association of Resource Conservation Districts	Statewide	Provide information & review current programs to provide for holistic water management. Strengthen and educate local leadership of Resource Conservation Districts to address water issues. Provide information and assessments which are available at the local level.
Watershed Alliance Council	Steven Day	North Coast	Biodiversity conservation planning and monitoring with citizen participation and access to Geographic Information System (GIS) in the California North Coastal Basin.
Watershed Alliance Council	Tim McKay	North Coast	Regional environmental education and activism. Work to educate, agitate and where necessary litigate to achieve protection and improvement for water quality and endangered salmonids. Publish "Econews" and produce "Econews Report."
Watershed Alliance Council	Kim Rodriquez	Northern Klamath area	none given
Watershed Alliance Council	Tom Weseloh	none listed	none listed
Watershed Alliance Council	Mark Bergstrom	none listed	none listed

GROUP	NAME	REGION COVERED	DESCRIPTION
Watershed Alliance Council	Danielle Gainok	North Coast	The Humboldt Fish Action Council is a 501 (c)(3) non-profit organization concerned with the survival of Northern CA's salmon populations. We are currently funded through the CA Salmon Stamp program to artificially propagate chinook salmon on Freshwater Creek, tributary to Humboldt Bay. We are also involved in monitoring local salmon and steelhead populations, making available life stage specific data for management and conservation of salmonids in Freshwater Creek.
Watershed Alliance Council	Ellen Fred	North Coast	Residents, property owners, concerned citizens protecting local watersheds.
Watershed Alliance Council	Larry Margler	North Coast	none listed
Watershed Improvement Network (WIN)	Save Our South Bay Wetlands	Pacific Southwest Regiion	Of San Francisco Bay's 200,000 acres of original wetlands, only 37,000 acres remain. Besides wildlife, these remaining wetlands and marshes are essential for pollution control, flood control, ground water rechard and saltwater intrusion control. Many of these remaining wetland parcels are proposed for development. SOS Bay Wetlands is acting to protect these wetlands and the quality of life they represent before they disappear.
Watershed Improvement Network (WIN)	Karen Solari	Pacific Southwest Regiion	The Six Rivers National Forest is one of 18 national forests in the Pacific Southwest Region of the US Department of Agriculture-Forest Service. The eighteen national forests in California cover only 20% of the land in the State but produce almost half the States runoff water. Because so much of California's water comes from the national forests, the health of our forest ecosystems and watersheds is critical. Many of California's national forests were created specifically to safeguard and preserve water supplies.
Watershed Management-education program through UC Davis	University of California Cooperative Extension	Statewide	The Watershed Advisor collaborates with landowners, watershed-planning groups & resource agencies to develop and implement scientifically sound watershed management plans & policies.

GROUP	NAME	REGION COVERED	DESCRIPTION
Watershed Processes and Erosion Control: A Workbook and Compendium *A Report of the FFFC Technical Committee*	The Fish, Farm and Forest Communities Forum (FFFC)	Statewide	The FFFC has three primary goals: 1) to facilitate the recovery of salmon and steelhead stocks in California, 2) to implement recovery measures voluntarily and proactively in cooperation with state and federal agencies based on the best available scientific evidence, and 3) to work towards those recovery programs which are the most cost effective and promote ecological, and social stability.
Wild on Watersheds	California Association of Resource Conservation Districts	Statewide	The program is a voluntary educational program to encourage a hands-on participation in watershed management.
Wolverton Gulch/Cummings Creek	none listed	none listed	Landowners on Wolverton Gulch and Cummings Creek have participated in restoration projects on their properties.
Yager/Van Duzen Environmental Stewards (YES)	none listed	none listed	YES is a group of landowners and resource managers working in Yager Creek, North Fork Yager Creek, Middle Fork Yager Creek, South Fork Yager Creek and the middle section of the Van Duzen River and associated tributaries. An inventory of 420 miles of roads will be completed in the spring of 2003 on YES member lands. All members must have a Water Quality Management Plan that has Best Management Practices designed to protect water quality.
Yurok Tribal Fisheries Program	none listed	Klamath Basin	They have developed a comprehensive watershed restoration plant for the lower Klamath River.
The Watershed Improvement Network	Ruth Blyther	Humboldt County	The Watershed Improvement Network is a collaborative alliance of watershed restorationists, planners, and managers throughout Humboldt County. Participants include citizens groups, private landowners, government agencies, private industry, native American tribes, educators, and small business owners. The long-term goal of the WIN project is to improve the health and productivity of Humboldt County's natural resources and economy.

E CALWATER Units

The CALWATER 2.2a system is the standard watershed mapping system used by the State of California. The CALWATER classification system includes (from largest to smallest) hydrologic regions, hydrologic units, hydrologic areas, hydrologic sub-areas, and planning watersheds. The following list includes the CALWATER units in the SONCC and CCC coho ESUs.

Hydrologic Unit (HU)	Hydrologic Area (HA)	Hydrologic Sub Area (HSA)	ESU
Winchuck River	Winchuck River	Winchuck River	SONCC
Rogue River	Illinois River	Illinois River	SONCC
	Applegate River	Applegate River	SONCC
Smith River	Lower Smith River	Smith River Plain	SONCC
		Rowdy Creek	SONCC
		Mill Creek	SONCC
	South Fork Smith River	South Fork Smith River	SONCC
	Middle Fork Smith River	Middle Fork Smith River	SONCC
	North Fork Smith River	North Fork Smith River	SONCC
	Wilson Creek	Wilson Creek	SONCC
Klamath River	Lower Klamath River	Klamath Glen	SONCC
		Orleans	SONCC
	Salmon River	Lower Salmon	SONCC
		Wooley Creek	SONCC
		Sawyers Bar	SONCC
		Cecilville	SONCC
	Middle Klamath River	Ukonom	SONCC
		Happy Camp	SONCC
		Seiad Valley	SONCC
		Beaver Creek	SONCC
		Hornbrook	SONCC
		Iron Gate	SONCC
		Copco Lake	SONCC
	Scott River	Scott Bar	SONCC
		Scott Valley	SONCC
	Shasta Valley	Shasta Valley	SONCC

Hydrologic Unit (HU)	Hydrologic Area (HA)	Hydrologic Sub Area (HSA)	ESU
Trinity River	Lower Trinity River	Hoopa	SONCC
		Willow Creek	SONCC
		Burnt Ranch	SONCC
		New River	SONCC
		Helena	SONCC
	South Fork Trinity River	Grouse Creek	SONCC
		Hyapom	SONCC
		Forest Glen	SONCC
		Corral Creek	SONCC
		Hayfork Valley	SONCC
	Middle Trinity River	Douglas City	SONCC
		Weaver Creek	SONCC
	Upper Trinity River	Upper Trinity River	SONCC
Redwood Creek	Orick	Orick	SONCC
	Beaver	Beaver	SONCC
	Lake Prairie	Lake Prairie	SONCC
Trinidad	Big Lagoon	Big Lagoon	SONCC
	Little River	Little River	SONCC
Mad River	Blue Lake	Blue Lake	SONCC
	North Fork Mad River	North Fork Mad River	SONCC
	Butler Valley	Butler Valley	SONCC
	Ruth	Ruth	SONCC
Eureka Plain	Eureka Plain	Eureka Plain	SONCC
Eel River	Lower Eel River	Ferndale	SONCC
		Scotia	SONCC
		Larabee Creek	SONCC
	Van Duzen River	Hydesville	SONCC
		Bridgeville	SONCC
		Yager Creek	SONCC
	South Fork Eel River	Weott	SONCC
		Benbow	SONCC
		Laytonville	SONCC
	Middle Main Eel River	Sequoia	SONCC
		Spy Rock	SONCC
	North Fork Eel River	North Fork Eel River	SONCC
	Upper Main Eel River	Outlet Creek	SONCC
		Tomki Creek	SONCC
		Lake Pillsbury	SONCC
	Middle Fork Eel River	Eden Valley	SONCC
		Round Valley	SONCC
		Black Butte River	SONCC
		Wilderness	SONCC

Hydrologic Unit (HU)	Hydrologic Area (HA)	Hydrologic Sub Area (HSA)	ESU
Cape Mendocino	Oil Creek	Oil Creek	SONCC
	Capetown	Capetown	SONCC
	Mattole River	Mattole River	SONCC
Mendocino Coast	Rockport	Usal Creek	CCC
		Wages Creek	CCC
		Ten Mile River	CCC
	Noyo River	Noyo River	CCC
	Big River	Big River	CCC
	Albion River	Albion River	CCC
	Navarro River	Navarro River	CCC
		Greenwood Creek	CCC
		Elk Creek	CCC
		Alder Creek	CCC
	Point Arena	Brush Creek	CCC
	Garcia River	Garcia River	CCC
	Gualala River	North Fork	CCC
		Rockpile Creek	CCC
		Buckeye Creek	CCC
		Wheatfield Fork	CCC
		Gualala	CCC
	Russian Gulch	Russian Gulch	CCC
Russian River	Lower Russian River	Guerneville	CCC
		Austin Creek	CCC
	Middle Russian River	Laguna	CCC
		Santa Rosa	CCC
		Mark West	CCC
		Warm Springs	CCC
		Geyserville	CCC
		Sulphur Creek	CCC
	Upper Russian River	Ukiah	CCC
		Coyote Valley	CCC
		Forsythe Creek	CCC
Bodega	Salmon Creek	Salmon Creek	CCC
	Estero Americano	Estero Americano	CCC
	Estero San Antonio	Estero San Antonio	CCC
	Bodega Harbor	Bodega Bay	CCC
Marin Coastal	Tomales Bay	Walker Creek	CCC
		Lagunitas Creek	CCC
		Inverness	CCC
	Point Reyes	Drakes Estero	CCC
	Bolinas	Bolinas	CCC

Hydrologic Unit (HU)	Hydrologic Area (HA)	Hydrologic Sub Area (HSA)	ESU
San Mateo	San Francisco Coastal	San Francisco Coastal	CCC
	San Mateo Coastal	Pacifica	CCC
		Half Moon Bay	CCC
		Tunitas Creek	CCC
	San Gregorio Creek	San Gregorio Creek	CCC
	Pescadero Creek	Pescadero Creek	CCC
	Año Nuevo	Año Nuevo	CCC
Bay Bridges	San Rafael	San Rafael	CCC
	Berkeley	Berkeley	CCC
	San Francisco Bayside	San Francisco Bayside	CCC
South Bay	East Bay Cities	East Bay Cities	CCC
	Alameda Creek	Alameda Creek	CCC
	San Mateo Bayside	San Mateo Bayside	CCC
Santa Clara	Fremont Bayside	Fremont Bayside	CCC
	Coyote Creek	Coyote Creek	CCC
	Guadalupe River	Guadalupe River	CCC
	Palo Alto	Palo Alto	CCC
San Pablo	Novato	Novato	CCC
	Petaluma River	Petaluma River	CCC
	Sonoma Creek	Sonoma Creek	CCC
	Napa River	Napa River	CCC
	Pinole	Pinole	CCC
Suisun	Fairfield	Benicia	CCC
		Suisun Creek	CCC
		Suisun Slough	CCC
		Grizzly Island	CCC
		Grizzly Island - in Delta	CCC
		Suisun Slough - in Delta	CCC
	Concord	Pittsburg	CCC
		Walnut Creek	CCC
		Martinez	CCC
		Pittsburg - in Delta	CCC
Big Basin	Santa Cruz	Davenport	CCC
		San Lorenzo	CCC
		Aptos-Soquel	CCC

F Watershed Prioritization

This document describes the data, processes, and methods used in getting to the Watershed Prioritization used by the CRT. It also discusses the limitations of the data and methods, and thus, the limitations of the results.

DATA USED IN THE ANALYSIS

Four maps were generated to implement the prioritizatin. This section describes each of these maps.

MAP 1: CONSISTENT PRESENCE

What: Shows the percentage of streams surveyed, in each HSA (Hydrologic Sub-Area), that have consistent presence of coho salmon over 2 or 3 years.

Data: Coho Presence/Absence (P/A) tables found in the Coho Recovery Team Watershed Summaries (provided by the regions)

Analysis: Since many of the watersheds had only 2 years of P/A data (2001 and 2002), the analysis was based on only the 2 years that were found consistently across all CALWATER hydrologic sub-area (HSA) watersheds. A handful of watersheds had additional years, and in those cases 2000 data was included.

Consistent Presence was defined as "surveyed and found in more than one of the 2 or 3 years of survey results, or surveyed and found in the only year surveyed." Then, by counting the number of streams surveyed per watershed (HSA), a percentage of consistent presence (Consistent Presence in 2 of 8 streams surveyed in that watershed = 25% Consistent Presence) was calculated.

Results were grouped into 6 rankings:

0 = No surveys in this watershed
1 = Streams surveyed, but no coho found
2 = Coho found, but no consistent presence
3 = 0-9% Consistent Presence
4 = 10-49% Consistent Presence
5 = 50-100% Consistent Presence

Shown below are the criteria used to determine if a stream had 'Consistent Presence':

FOR STREAMS WITH 2 YEARS' OF SURVEY RESULTS

CONSISTENT PRESENCE?	YEAR	YEAR
N	-	-
N	A	-
N	A	A
N, but coho found	P	A
Y	P	-
Y	P	P

FOR STREAMS WITH 3 YEARS' OF SURVEY RESULTS

CONSISTENT PRESENCE	YEAR	YEAR	YEAR
N	-	-	-
N	A	(A)	(A)
N, but coho found	P	A	-
N, but coho found	P	A	A
Y	P	P	A
Y	P	-	-
Y	P	P	-
Y	P	P	P

Limitations: This map was produced using presence/absence data, not abundance data. So it doesn't represent the total numbers of fish in any given HSA, just that they were there. Also, since a consistent field data capture technique was used only in recent years, there is only 2-3 years of data to look at, which limits the scope of the results. Finally, this map only shows where streams have been surveyed and whether coho were found. Many streams were not surveyed. This creates a bias based on how many streams were surveyed in a given HSA. Some HSAs had only 1 or 2 streams surveyed and could receive a 50% or 100% Consistent Presence with only 1 or 2 streams having coho presence, while other HSAs had 20+ streams surveyed and could have many more streams with coho presence and still not reach the 50% Consistent Presence mark. The streams that were surveyed, however, were based on historic data that showed where the coho were most likely to be found, and it was assumed that there are very few additional streams that could have been surveyed where coho would have been found.

MAP 2: COHO POPULATION AND RISK

What: Shows the combination of Coho Population factors and Risk factors by HSA.

Data: This map represents the compilation of several data sources. See below for details on the 6 combined analyses used.

Analysis: The rankings for the 3 coho population factors were first added together, and then the 3 risk factor rankings were added together and divided by 3. This added the risk factors in as equivalent to each individual population factor. Finally, both totals were added and then grouped into quintiles separately for each ESU.

Limitations: This map was produced by combining the rankings of 6 separate analysis (3 for coho population factors, and 3 for risk factors). See below for specific limitations on each of these.

Compiled Analysis: The following 6 items represent individual analyses that all went into the Coho Population and Risk Map. All of these analyses involved assigning a score to each HSA and then grouping the scores into ranks (usually 1-5). Since there are many factors that differ between the 2 ESUs (ecologically significant unit), these range breaks were often created separately for each ESU (3, 4, and 6).

1. **Consistent Presence** – see previous map

2. **Isolation Index**

Data: CALWATER 2.2 watersheds and 'Consistent Presence' data created from Presence/Absence data from Coho Recovery Team Watershed Summaries.

Analysis: This analysis assessed the geographic isolation of every watershed (HSA) that had any level of 'consistent presence' (codes 3, 4, or 5). To accomplish this, the following was done for each watershed that fell into this category:

1. Selected all watersheds within the same Hydrologic Unit (HU) that were at least partially within a 5 mile radius of the boundary of the selected watershed.

2. Summed the area of all of the selected border watersheds.

3. Summed the area of all of the selected border watersheds that also had some level of consistent presence.

4. Calculated the percentage of 'consistent presence' area out of the total area. The lower the percentage of nearby 'consistent presence' watersheds, the more isolated the ranking.

The rankings were as follows:

1 = 100-70% (not very isolated)
3 = 70-45% (somewhat isolated)
5 = 45-0% (very isolated)

Limitations: This analysis is based on the proximity of HSA watersheds to other HSA watersheds within the larger HU watershed unit. It does not look at direct hydrologic connectivity, but at clusters of HSA that eventually drain to the same point.

3. Run Length

Data: 100K DFG Streams layer from Eric Haney (Region 1)

Analysis: For this analysis we first took the downstream stream length from the output point of each watershed (HSA) to the mouth (ocean or SF Bay). We then added a 'pseudo radius' value was calculated for each watershed based on its area. This addition created a run length that pushed partially into the watershed, and it also gave us run lengths for coastal watersheds that otherwise would have received a zero value. We then grouped the results into rankings based on 5 categories (different ranges for the 2 ESUs).

High rankings were given to both very short and very long runs, with the assumption that these represented potential unique populations of coho.

RANKING	SONCC	CCC
5	0-13 miles	0-4 miles
3	14-40	5-6
1	41-82	7-8
3	83-126	9-11
5	127-200	12-31

Limitations Because good point location data for the coho are not available, exact run-lengths to spawning areas could not be calculated;. Instead, an average value (that goes mid-way into the HSA where there are coho) was calculated.

4. Census Population Density

Data: Year 2000 Census Data from DFG library (by Census Tract)

Analysis: For this analysis the existing Density Class field (1-10) was used in the data, and aggregated up from Census Tract to HSA. For each Census Tract (or part of a Census Tract as clipped by the HSA boundary), the Density Class was multiplied by the percentage area of the Tract to the HSA, and then all the pieces were added. The results were then grouped into 5 rankings for each ESU.

Limitations: A risk to the coho population is inferred based on the density of people. While the Census data are fairly accurate, the relationship of human density to coho risk is not necessarily a direct linear one.

5. Points of Water Diversion

Data: State Water Resources Control Board's Water Rights Information System (data from 12/2002).

Analysis: Within the historical range of coho, the points of diversion were summarized by HSA. The totals were then grouped into ranks based on percentiles:

PERCENTILE	RANGE	RANK
50%	0-19	1
60%	20-41	2
70%	42-64	3
80%	65-186	4
95%	187-1045	5

≈

Limitations: The data used for this analysis were the best available and capture almost all water diversions from streams. However, what they doesn't capture (at this time) is the amount of water pulled out at each diversion. Some diversions may be for a single residence, while another may be for a very large water district transfer or large irrigation project. Ideally, the amount of water diverted rather than the number of diversions would be used.

6. Road Density

Data: 100K Roads data from DFG library (USGS DLG data by county)

Analysis: Miles of roads per watershed (HSA) were counted and then divided by total square miles per watershed to get a miles/sq mile figure. The results were then grouped into 5 rankings for each ESU.

Limitations: The 100K Roads data used for this analysis are the best available for the whole coho range at this time. However, at the 100K scale of data capture, large numbers of smaller rural roads are left out, thus somewhat diminishing the road density in the rural areas. Ideally, 24K Roads data would be used.

MAP 3: PRIORITIZED WATERSHEDS FOR MANAGEMENT ACTIONS

What: Shows the combination of Coho Population factors, Risk factors and Watershed Status by HSA.

Data: This map represents the compilation of several data sources. It starts with Map 2: Coho Population and Risk (see above) and adds a combined Watershed Status analysis that was compiled based on the professional opinion of Department field staff on 3 categories for each HSA: Potential Habitat, Disconnected Habitat, and Watershed Condition.

Analysis: Department field staff were asked to rank each HSA (1-5) in their region based on the following 3 categories: 1) Potential Habitat, stream gradient and pools; 2) Disconnected Habitat, barriers; and 3) Watershed Condition, overall condition, impairments, disturbances. These ranks were then added together and added to the totals from Map 2: Coho Population and Risk. The totals were then grouped into ranks (1-5) separately for each ESU.

Limitations: The limitations for this map include the limitations from Map 2: Coho Population and Risk. In addition, the 3 ranks collected from Department field staff are subjective.

MAP 4: DISCONNECTED HABITAT

What: Shows the amount and type of stream barriers to coho migration.

Data: These data are based on the professional opinion of DFG field staff.

Analysis: Department field staff were asked to rank each HSA (1-5) in their region based on Disconnected Habitat. The possible categories are as follows:

N/A = not current or known historic coho habitat

0 = natural, permanent, or year-round barrier to coho migration

1 = an extremely large barrier (i.e. major dam like Iron Gate) or an extremely large number of confirmed barriers

2 = large numbers of confirmed barriers

3 = a moderate number of barriers need to be removed or modified to allow all life stages passage to restorable coho habitat

4 = a few barriers need to be removed or modified to allow all life stages passage to existing coho habitat

5 = none to very few barriers need to be removed or modified to allow all life stages passage to existing coho habitat

Limitations: The data for this map are based on professional opinions from Department field staff and are subjective.